**See Tri-County Watersheds and Major Streams Map at:**

**http://www.metrokc.gov/exec/orpp/benchmrk/bench01/wtrshd_tricnty.pdf**

**INDICATOR 13:**

*(continued from previous page)*

## What We Are Doing

- Undertaking in-stream habitat restoration.
- Removing culverts that impede fish migration.
- Providing flood control.
- Enhancing and protecting streambanks with revegetation projects and rechannelization.
- Purchasing land at the headwaters of salmon streams and conserving it as "open space".
- Introducing wider stream buffers where needed to protect fish habitat.
- Providing incentives to protect wetlands through programs such as Wetland Mitigation Banking.
- Sponsoring volunteer and education programs such as the Hazardous Waste Education Program, Salmon-watchers, Lake Stewardship, Plant Partners Stewardship and Cedar Naturalist Program.

**Data Source:** King County Department of Natural Resources, Water and Land Resources Division, 1999. An Atlas of the Watersheds of King County, Washington, 1995.

**Policy Rationale:** The policy rationale stems from Countywide Planning Policies CA-5 and CA-6. The preservation of surface water quality is critical, because approximately 80% of the drinking water supplying this region comes from rivers such as the Tolt and the Cedar. Salmon and other aquatic life also require high quality water for their healthy development and survival.

Fig. 13.6

**Biotic Integrity (B-BIBI) Scores for Streams in Four King County Basins**

| Biomonitoring Site | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | Average for Years with Data | Status by Average B-IBI |
|---|---|---|---|---|---|---|---|---|
| **Green River Basin** | | | | | | | | |
| Little Soos Creek | 14 | | 14 | | no access | | 14 | Seriously Degraded |
| Upper Soos Creek | 20 | | 20 | | 18 | | 19 | Seriously Degraded |
| Upper Jenkins | | | | 22 | flow too low | | 22 | Moderately Degraded |
| Lower Jenkins | 30 | | 28 | 30 | 28 | | 29 | Moderately Degraded |
| Lower Soos Creek | 28 | | 28 | | 34 | | 30 | Moderately Degraded |
| Lower Covington Creek | 34 | | 30 | | 38 | | 34 | Moderately Healthy |
| Lower Soosette Creek | 36 | | | 34 | 34 | | 35 | Moderately Healthy |
| Upper Covington Creek | * | | 32 | | 40 | | 36 | Moderately Healthy |
| **Big Bear Creek Basin** | | | | | | | | |
| Upper Bear Creek | 26 | | | | 20 | 14 | 20 | Moderately Degraded |
| Lower Bear (mouth) | 22 | | | 20 | 28 | 24 | 24 | Moderately Degraded |
| Mid Evans | * | 26 | 24 | 18 | 24 | 26 | 24 | Moderately Degraded |
| Low Mid Bear (133rd) | 34 | * | 28 | | 26 | 16 | 26 | Moderately Degraded |
| Trib 0111A | * | | 30 | | 22 | 28 | 27 | Moderately Degraded |
| Mackey Creek | 26 | | | 32 | 24 | 28 | 28 | Moderately Degraded |
| Cottage Lake Creek | 36 | 28 | 26 | | 30 | 22 | 28 | Moderately Degraded |
| **Issaquah Creek Basin** | | | | | | | | |
| North Fork Issaquah Creek | | 28 | | 34 | | 20 | 27 | Moderately Degraded |
| Middle Issaquah Creek @ KC park | | 30 | | 32 | | 28 | 30 | Moderately Degraded |
| Holder Creek | | | 28 | 32 | | 32 | 31 | Moderately Healthy |
| East Fork Issaquah Creek | | 30 | | 36 | | 32 | 33 | Moderately Healthy |
| Lower Issaquah Creek @ 56th St. | 36 | 28 | | 34 | | 34 | 33 | Moderately Healthy |
| Upper Issaquah Creek @ 165th | 32 | | | 36 | | 34 | 34 | Moderately Healthy |
| Carey Creek @ Iss-Hobart Rd | 36 | 34 | | 40 | | 30 | 35 | Moderately Healthy |
| Black Nugget Creek | | 48 | | 42 | | flow low | 45 | Healthy |
| **Cedar River Basin** | | | | | | | | |
| Upper Lower Peterson Creek | | 24 | | 26 | | 16 | 22 | Moderately Degraded |
| Lower Lower Peterson Creek | | 28 | | 26 | | 28 | 27 | Moderately Degraded |
| Lower Walsh Creek | | 26 | | 28 | | 36 | 30 | Moderately Degraded |
| Taylor Creek | | 30 | | 34 | | 34 | 33 | Moderately Healthy |
| Upper Rock Creek | | 32 | | 40 | | 34 | 35 | Moderately Healthy |
| Lower Rock Creek | | 38 | 46 | 48 | | 46 | 45 | Healthy |

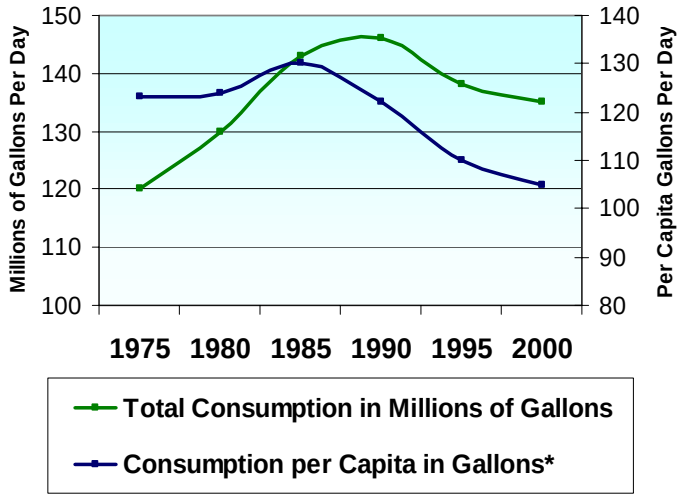
* Indicates that scores could not be calculated.

## *Outcome: Protect Water Quality and Quantity*

### INDICATOR 14. Water consumption.

Fig. 14.1

**Billed Water Consumption in King County: 1975 - 2000**




*Definitions and Notes:*

1. *The Seattle Public Utilities (SPU) supplies water, primarily from the Tolt and Cedar River watersheds, to about 76% of King County residents. This includes water that is sold wholesale to hundreds of smaller water purveyors that serve outlying areas of the County. Edmonds and Olympic View receive some of their water directly from SPU, although they are both outside King County. Water District 83, Redmond and Highline are also within the SPU service area, but have other sources of supply. Water from other sources amounts to about 7 million gallons per day which are not included in the table above or the graph below.*
2. *The table represents total billed water consumption per capita and total billed consumption sold both retail and wholesale by SPU, which also includes purveyor non-revenue water.*
3. *Billed consumption does not include unmetered (non-revenue) water such as main and reservoir flushing, leaks, etc. The graph below represents billed consumption in million gallons per day by residential and commercial customers, as well as wholesale water consumption.*

Fig. 14.2

**Billed Water Consumption Per Day**

| Year | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 |
|---|---|---|---|---|---|---|
| Consumption **per Capita** in Gallons | **123** | **124** | **130** | **122** | **110** | **105** |
| **Total** Consumption in Millions of Gallons | **120** | **130** | **143** | **146** | **138** | **135** |

## About This Indicator

- Per capita water usage in 2000 remained at about the same level as 1999. At just under 105 gallons per capita in 1999 and 2000, water consumption is at its lowest level since 1993.
- The 1992 drought brought about a dramatic drop in water consumption. Only 101 gallons per capita were used in 1992 and 103 gallons per capita per day were used in 1993.
- Overall, water consumption per capita is notably lower this decade than in the 1980's when it showed an upward trend.
- Total water consumption has decreased since 1990, despite a growing population.
- Total residential consumption has declined slightly in relation to commercial consumption. Residential uses represented about 44% of direct billed consumption in 1975 and about 40% in 1999.

## What We Are Doing

- Promoting intensive conservation measures, including low-flow showerheads and faucets, and water-efficient clothes and dishwaters.
- Requiring the sale of low-flush toilets, and offering incentives to replace older toilets with new low flush models.
- Encouraging use of dishwashers and clothes washers for full loads only.
- Limiting lawn and garden watering during high demand times; promoting native landscaping requiring less additional watering.
- Protecting fisheries and wildlife by allowing adequate in-stream flows in rivers and streams.

**Data Source**: Seattle Public Utilities, 1999.

**Policy Rationale:** The policy rationale stems from Countywide Planning Policies CO-4, CO-5, CO-6 and CO-7. Adequate long- and short-term water supplies are critical for our region's residential, commercial and industrial uses. The protection of watersheds are essential elements in enhancing the environmental integrity of the area.

## *Outcome: Protect Water Quantity and Quality*

**INDICATOR 15:** Changes in groundwater levels and groundwater quality.

*Groundwater is a significant natural resource in King County, providing drinking water for approximately 30% of the County's population. Moreover, groundwater is often the only feasible source of water in rural areas. During the dry season, groundwater provides base flow in streams, which is the essential component of aquatic habitat for fish and other wildlife.*

### A. Change in Groundwater Quality

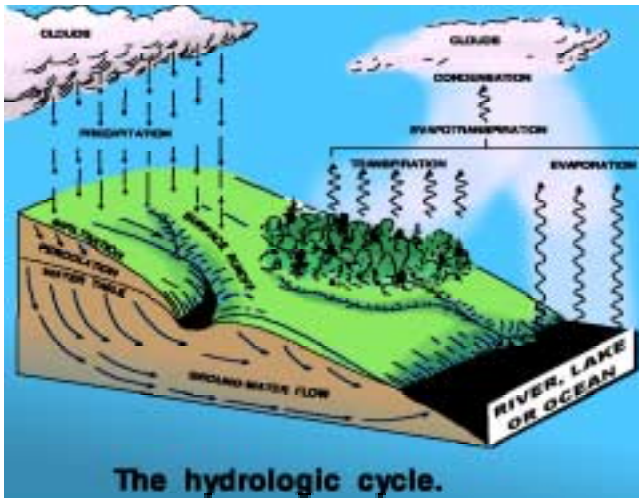
Fig. 15.1

| Long Term Trends in Groundwater Quality | |
|---|---|
| **Chemical Parameter** | **Change in Concentration between 1989-95 and 2001** |
| **Potassium** | *Increased* |
| **Iron** | *Increased* |
| **Magnesium** | *Increased* |
| **Copper** | *Decreased* |
| **Fluoride** | *Decreased* |
| **Lead** | *Decreased* |
| **Zinc** | *Decreased* |

***Definitions and Notes:***

1. In early 2001, King County staff restarted groundwater monitoring across the county. This monitoring was last conducted between 1989 and 1995 as part of data collection efforts for Ground Water Management Plans.
2. The monitoring is designed to detect overall changes in water quality or quantity since 1995 that may continue into the future. Samples were taken from 66 wells and two springs in four Ground Water Management Areas: Vashon; Bear Creek Valley (Redmond); Issaquah Creek Valley; and East King County. These were the same sites that had been monitored during the last period of monitoring from 1989 – 1995. The previous chemical analyses and the new round were entered into a comprehensive database and compared statistically for changes between the two data sets. So far, the 2001 analytical data includes only 55 of the total 68 sites sampled (three of the four groundwater management areas). No data were included for the samples from the Redmond - Bear Creek Valley area because analyses had not been completed prior to publication of this report. In addition, the samples represent only the winter to spring season of the year since sampling was done in January to April, 2001.
3. Future reports will include more wells and a second round of sampling to be conducted later, in Fall 2001, to complement the results from the Spring sampling.
4. It should be noted that out of the 66 wells sampled for water quality, only 31 wells could be analyzed for changes in groundwater quantity. Generally, this is because there was insufficient amount of data, either old or new, to make meaningful comparisons between the original and the new rounds of monitoring.

Fig.15.2



The hydrologic cycle.

## About This Indicator

- Based on sampling results, overall groundwater quality in King County is high. Very few of the samples exceeded Washington State Department of Health primary drinking water quality standards.
- The most common exceedances of any water quality standards involved iron and manganese. However, water quality standards for iron and manganese are considered Secondary Drinking Water Standards. This means that the water does not pose a health risk, but has undesirable aesthetic qualities such as taste or color.
- A number of samples exceeded the "recommended level" for sodium, which could be of a health concern for residents on a restricted sodium diet.

  A few locations showed more serious water quality problems. Two wells in East King County and two springs sampled on Vashon Island had detectable levels of total coliform bacteria. Since filtration can remove bacteria, a follow-up sample was obtained at these sites, post-filtration, to see if water supplies were compromised. Information on disinfection was supplied to property owners.

**INDICATOR 15:**

*(continued from previous page)*

- Two well samples exceeded the existing drinking water standard for arsenic (at 50 parts per billion). One of these was probably caused by a sampling artifact. In the other case, the previous results from the well showed that this was a long-term problem that had not notably increased or decreased.

### A. Change in Groundwater Quantity

***Definitions and Notes:***

1. *An **aquifer** is the underground material where water is stored. A **groundwater well** taps into an aquifer to bring water to the surface. The water level in a groundwater well reflects the water level in the aquifer, which in turn indicates the volume of water in aquifer storage.*
2. *The procedure used for water quality monitoring includes measurement of the standing water level in the well. The water levels measured during this recent monitoring round were compared to the levels observed during the 1989 - 1995 sampling rounds to see if any long-term trends were apparent. This comparison is of special interest to residents since drought concerns were raised during the time of the 2001 monitoring round.*
3. *Some limitations of the existing data include:*
   - *Considerable fluctuations in measured water levels exist in a few wells (among both old and new data) that could be the result of either residual drawdown from pumping, or errors in measurement.*
   - *The 2001 sampling round was conducted in the winter to spring season, when water levels are normally high. Therefore new record of water level lows may be yet to appear.*
   - *Some of the old data were from observations taken in 1992, which was also a drought year.*
   - *Many of the wells are very deep (one is 450' deep), and the effects of a drought may take years to reach the groundwater to have a measurable impact.*
4. *When the second round of water quality sampling is conducted in summer - fall 2001, some of these issues may resolve, thus allowing a more definitive conclusion. The new "record lows" were observed only in the East King County and the Issaquah Creek Valley areas. Conversely, the new "record highs" were observed only in the Redmond - Bear Creek Valley and the Vashon - Maury Island areas. This geographical variation will also be tested in the subsequent monitoring round.*

## About This Indicator

- There is little evidence of a general trend toward a significant increase or decrease in groundwater throughout King County since the earlier rounds of monitoring.
- The 2001 monitoring round shows water levels that are higher than previous observations ("record highs") in 6 wells, but also "record lows" in 3 wells. The existing data are insufficient to detect a real trend.
- When aquifer storage is high, more groundwater discharges and streams will have higher baseflows. (See Fig. 15.2) When storage is low, streams will have low baseflows and may dry up altogether in dry summer months. In addition, groundwater wells run dry if the aquifer level drops below the pump intake level.
- Aquifer levels fluctuate depending on the cumulative amount of recharge to the aquifer and the amount of withdrawals from the aquifer. Levels normally rise during the winter wet season and fall in the summer dry season. However, many outside factors affect the aquifer recharge rate.
- Changes of land use in an aquifer's recharge area - for instance, from natural vegetation to impervious surfaces such as pavement or concrete - can permanently reduce recharge.
- Withdrawals from wells for water supplies can further deplete aquifer storage quantities and lower levels in the aquifer.
- Finally, climatic variations such as drought can cause aquifer levels to drop further. This drop in aquifer levels can put ecosystems and residents who rely on these water supplies at risk. Thus it is vital to monitor water levels to assure that aquifers are not being depleted.

## What We Are Doing

- Discouraging practices which contribute to either chemical or biological contamination of wells and springs: excess use of fertilizers, run-off from traffic areas, from industrial and construction activity, and from agricultural activity involving animal waste.
- Limiting development activity in rural areas, particularly if it involves increases in impervious surface, in order to protect the quantity of water in aquifers and to assure an adequate base flow in streams.
- Notifying well owners of water quality problems, and advising on treatment systems that could make the water safer for consumption.
- Educating those served by groundwater wells in ways to conserve water.

**Data Sources:** King County Department of Natural Resources, Water and Land Resources Division.

**Policy Rationale:** The policy rationale stems from Countywide Planning Policies CA-5 and CA-15. This Indicator alerts officials and citizens of the need to monitor groundwater quantity to assure sustainability and prevent depletion.

## *Outcome: Protect Wetlands*

**INDICATOR 16:** Change in wetland acreage and functions.

Fig. 16.1

| King County Wetland Systems | | | |
|---|---|---|---|
| | **Description** | **Approx. Acreage** | **Percent of Total Wetland Acreage** |
| **Estuarine** | Tidal/ Salt Water Habitats | 147 | 0.5% |
| **Lacustrine** | Lakeshore or Lake-like Wetlands With Few Trees or Shrubs | 5,077 | 16% |
| **Palustrine** | Non-Tidal Wetlands Dominated by Trees, Shrubs, etc. | 22,145 | 69% |
| **Riverine** | Wetlands Associated with Rivers or Streams | 2,441 | 8% |
| **Unclassified Wetlands** | | 2,529 | 8% |
| **Total Wetlands*** | | 32,300 | 100% |
| **Lakes, Rivers and Reservoirs** | | 45,000 | |
| **Note that this acreage excludes open water acreage assigned to lakes and rivers. Nor does it include small wetlands that have not yet been identified and/or mapped.* | | | |

***Definitions and Notes:***

1. *The data in the table above is derived primarily from two sources: the National Wetlands Inventory, created in 1989 from photos taken in the 1970s and 1980s, and the King County GIS Wetlands Coverage, created in 1995 and updated in 2000. These two sources have many wetland areas in common, but each contains some wetlands not identified by the other source.*
2. *An accurate, current account of the number of acres in wetlands is very difficult to achieve. The numbers given in the table above are subject to several possible sources of error: a) Both the datasets depend on surveys or photos which are likely to be somewhat out of date; b) Wetlands and open water areas (rivers, lakes, and bays) are often adjacent to each other so that it is difficult to separate one from the other – they change with the seasons and the year's weather conditions; c) the overlap in the two data sets makes it challenging to ascertain how much total acreage is in wetlands without double-counting or undercounting.*

## About This Indicator

- King County has approximately 32,000 acres of identified wetlands. Because trend data is not yet available it is difficult to say whether or not there has been any net loss of wetland acreage.
- Wetlands are highly valued for many of the functions that they provide. These include habitat, stormwater control, groundwater recharge, water quality protection and open space.
- Wetlands are biologically highly productive ecosystems and are essential to a vast diversity of species, including birds, fish, reptiles, invertebrates and mammals for feeding, nesting, cover and breeding. At least 1/3 of Washington State's threatened and endangered species require wetlands for their survival.

## What We Are Doing

- Designating wetlands as sensitive areas, and requiring buffers between wetlands or shorelines, and development activity.
- Providing flood control.
- Providing incentives to protect wetlands through programs such as Wetland Mitigation Banking.
- Making efforts to update geographic information on wetlands and other critical areas based on permit activity.
- Monitoring quality of wetland functions through amphibian studies.
- Sponsoring and encouraging citizen volunteer programs such as the "Wetland Restoration Saturdays". Enhancing and protecting wetlands and streambanks with revegetation projects and rechannelization.

**Data Sources:** National Wetlands Inventory. U.S. Dept. of Fish and Wildlife, 1989. King County Dept. of Development and Environmental Services (DDES), Wetlands Coverage, 1995, 2000.

**Policy Rationale:** The policy rationale stems from Countywide Planning Policy CA-3. This Indicator is designed to evaluate whether the policy of "no net loss" of wetland functions and acreage is being achieved. In the long term, the quantity and quality of wetlands should be increased.

**See King County Wetlands and Water Bodies Map at:**

**http://www.metrokc.gov/exec/orpp/benchmrk/bench01/kcwetlands01.pdf**

**See King County Wetlands and Water Bodies Map at:**

**http://www.metrokc.gov/exec/orpp/benchmrk/bench01/kcwetlands01.pdf**

## *Outcome: Protect the Diversity of Plants and Wildlife*

**INDICATOR 17:** Continuity of terrestrial and aquatic habitat networks.

*King County is home to a number of threatened or vulnerable species. Among these are the bald eagle, the peregrine falcon, grey wolves, spotted owls, common loons, piliated woodpeckers, and great blue herons. Many of these species, as well as other native species that are currently thriving, require relatively large connected blocks of habitat. The designation of the wildlife habitat network by the King County Comprehensive Plan is a first step in helping to preserve that continuity.*

Fig. 17.1

**Development Activity within the Terrestrial Habitat Network: 1994 - 1999**

| | Parcels Within or Adjacent to Network | Parcels with Activity Covered by Habitat Network Codes | Permits Reviewed for Compliance with Network Codes |
|---|---|---|---|
| Number | 3655 | 623 | 105 |
| Percent of Total | 100% | 17% | 3% |

***Definitions and Notes:***

1. *The wildlife habitat network is designated in the 1994 King County Comprehensive Plan, and is implemented through KCC 21A.14.260 - .270. The map on the following page shows all existing land parcels within 150 feet of the network on each side. The network code requirements would not necessarily apply to all of these parcels since the code only requires a minimum total network width of 150 feet (or 75 feet on each side). However, since the code aspires to a network width of 300 feet, all parcels within that range are shown.*
2. *Many of the parcels potentially affected by the network are currently in public ownership, and most are also affected by sensitive areas ordinances since those were two important criteria in the selection of the habitat network route.*
3. *Some types of permit activity, such as clearing and grading permits, and other miscellaneous categories, are not covered by the network code.*

## About This Indicator:

- Significant gaps in the continuity of the terrestrial wildlife habitat remain. Some of these can be identified on the map following.
- As habitats become more fragmented by development much of their function is lost. If habitats are fragmented, there may actually be less usable habitat available than a simple count of acreage would indicate.. By tracking and limiting development within and adjacent to the network, fragmentation of the habitat can be prevented before it occurs.
- From 1994 – 1999, out of the 3,655 parcels within or adjacent to the habitat network, 17% had permit activity that would be covered by the network codes. However, only 3% were reviewed for compliance with these codes.
- Loopholes in the wildlife network codes, make it difficult to ensure protection of these habitats. Efforts to close the loopholes have been postponed several years until comprehensive policies and codes to protect aquatic and terrestrial habitat can be implemented.
- No data is currently available to determine continuity of aquatic habitat. The information above deals only with terrestrial habitat.

## What We Are Doing

- Purchasing land to conserve open space that will augment the wildlife network.

**Data Sources:** Open Space and Land Resource Section, Department of Natural Resources, 1998 & 1999.

**Policy Rationale:** The policy rationale stems from Countywide Planning Policies CA-7 and CA-8. Obstacles/barriers such as roads and buildings can interfere with the intent of a continuous countywide habitat network. They interfere with a species' space requirement and its ability to seek adequate food, cover, and water. Any obstacles/barriers need adequate mitigation to reduce impacts to wildlife/fish species. Jurisdictions will promote wildlife protection and integrate native plant communities and wildlife with other land uses where possible, according to Countywide Planning Policy CA-7.

Backside of Indicator 17 (no printing)

**See Wildlife Habitat Network Permit Activity Map at:**

**http://www.metrokc.gov/exec/orpp/benchmrk/bench01/wildnet01.pdf**

**See Wildlife Habitat Network Permit Activity Map at:**

**http://www.metrokc.gov/exec/orpp/benchmrk/bench01/wildnet01.pdf**

## *Outcome: Increase Salmon Stock*

### **INDICATOR 18:** Change in the number of salmon

Salmon in Puget Sound have diverse life histories and rely upon different habitats at various points in their life history for spawning, rearing, feeding and migrating. They therefore can be an important source of information about the health of those habitats. The abundance, geographic distribution, genetic diversity and productivity of salmon can be indicative of the overall health of their ecosystem, of which the freshwater and saltwater portions of King County are an important part. This indicator focuses only on information related to changes in the quantity of salmon.

***Fig. 18.1***

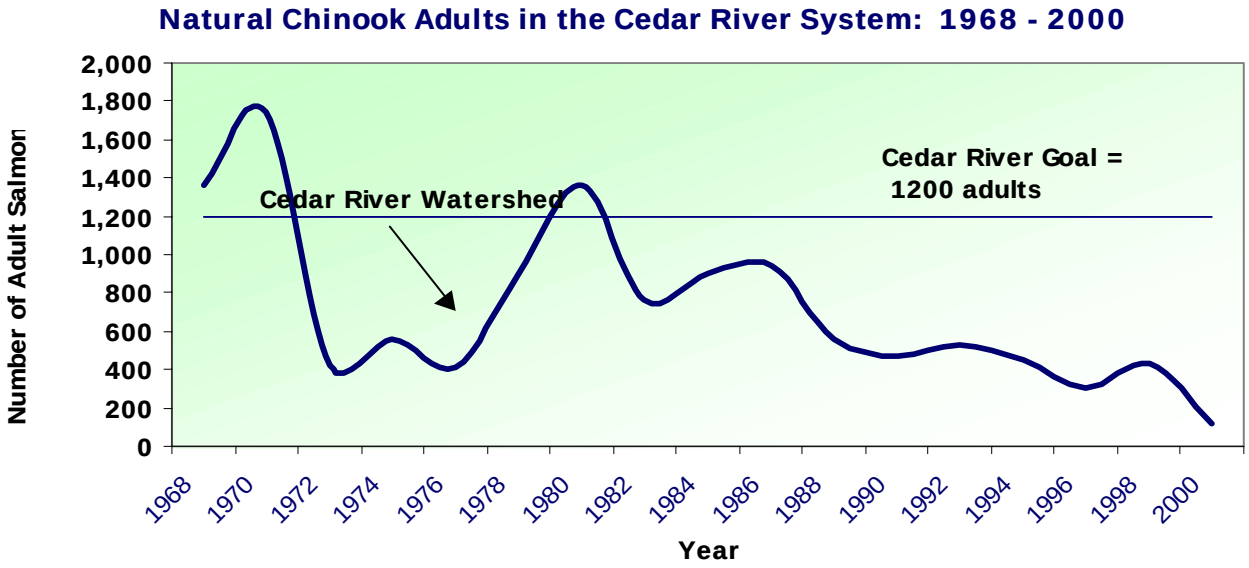
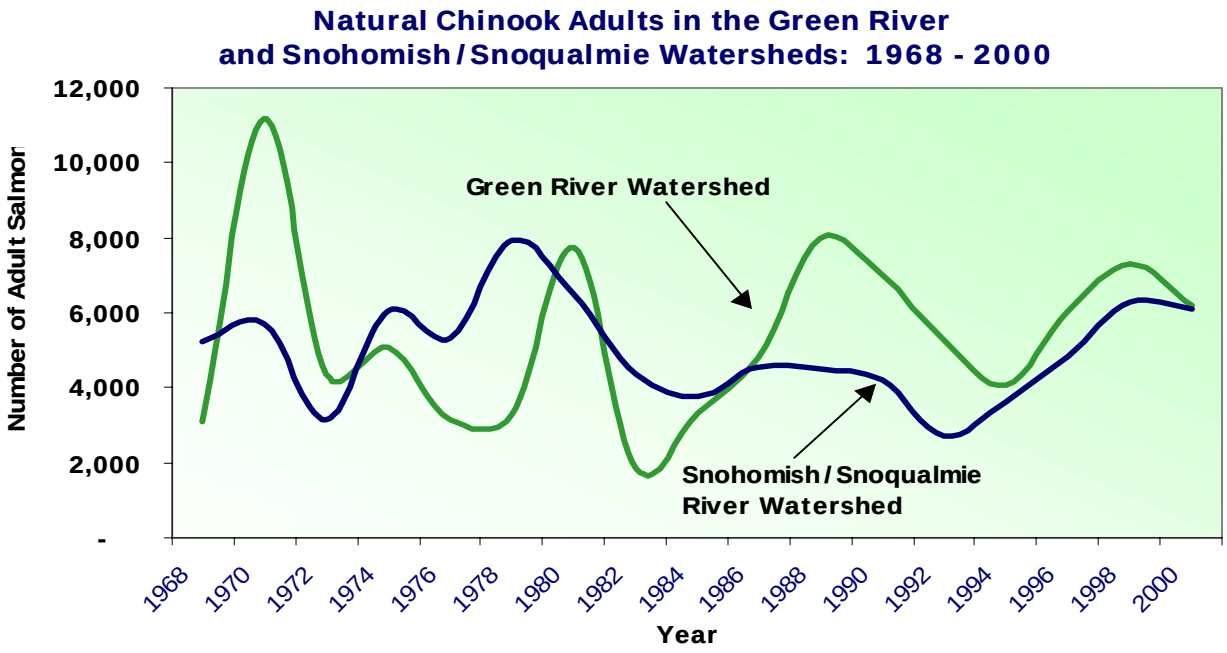



Fig 18.2



**INDICATOR 18:**

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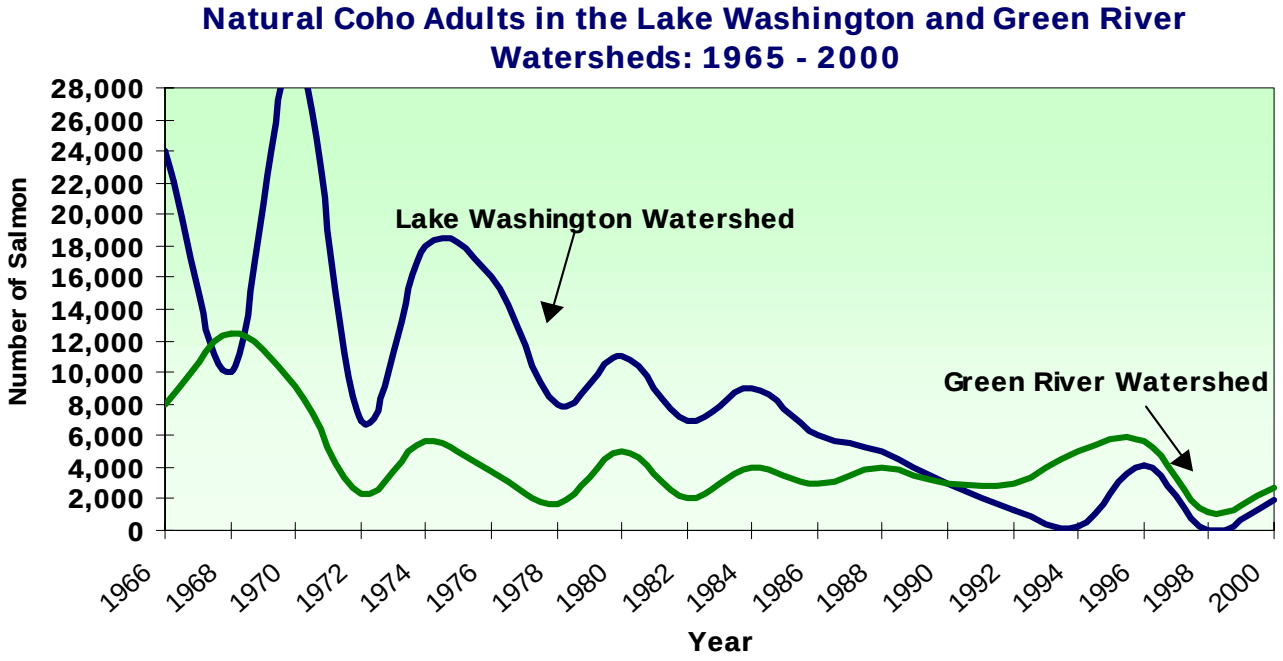
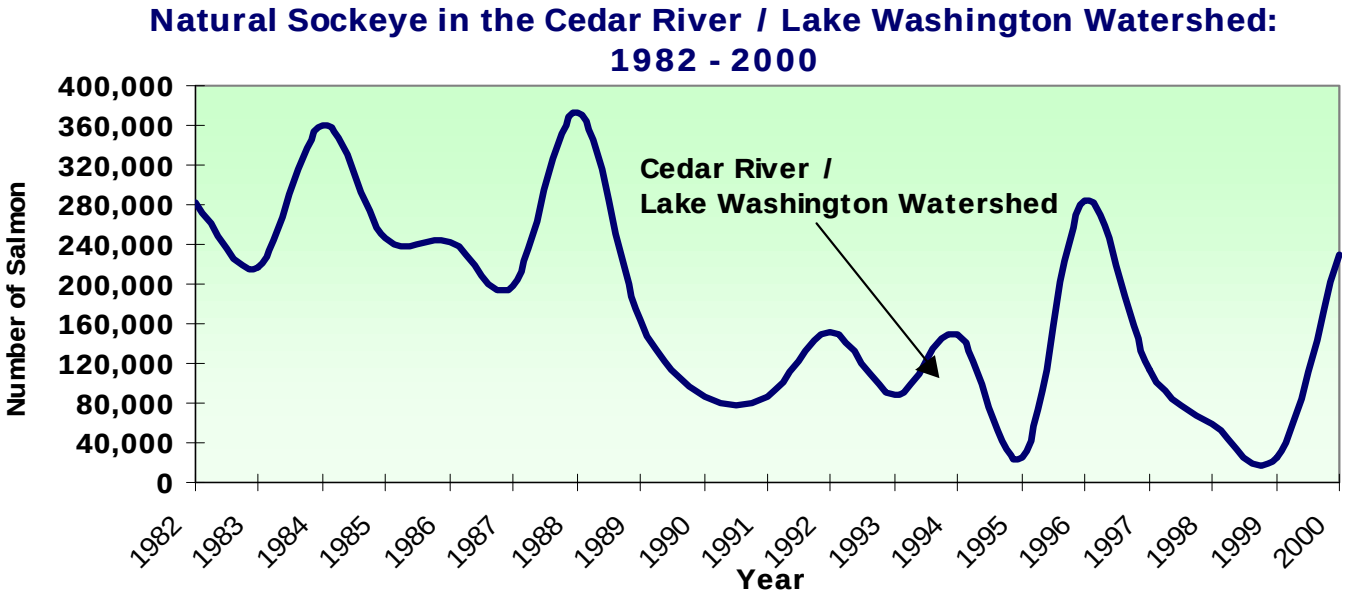



***Fig. 18.4***




***Definitions and Notes:***

1. *For salmon and steelhead stocks, the term escapement refers to those mature fish that have returned to freshwater, have survived all fisheries and constitute the spawning population for a given stock. All data presented in the graphs are escapement data.*
2. *The term natural fish refers to those fish that spawn naturally whether or not they originated in a hatchery or in the wild.*
3. *The Lake Washington System is comprised of the Cedar River and its tributaries, Bear Creek, Issaquah Creek, Lake Sammamish and the Lake Washington and North Lake Washington tributaries. See Indicator #13 above for a map of King County watersheds.*
4. *The Green River Watershed includes the Duwamish River and the Green River and its tributaries. The Snoqualmie-Snohomish Watershed includes the Skykomish, Snoqualmie, and Snohomish sub-basins and their tributaries. Over one-half of this watershed lies in King County.*

**INDICATOR 18:**

*(continued from previous page)*

## About This Indicator

*General*

- The Puget Sound Basin provides habitat for a total of 209 salmon and steelhead stocks. The 1992 SASSI (Washington State Salmon and Steelhead Stock Inventory) assessment categorized 44% of these stock as healthy, 21% depressed, 5% critical, 29% unknown and 0.2% extinct.
- Qualitative and quantitative data from over the last century indicate a precipitous and continuous decline in the abundance of native, naturally spawning salmon in Puget Sound watersheds, and in watersheds up and down the west coast generally. For some stocks the decline has been an order of magnitude, e.g., from 10,000 returning fish to 1,000.
- The gravity of this decline has been confirmed by the listing of Chinook salmon and bull trout under the Endangered Species Act, and by the real potential that a number of other salmonid stocks, including Coho and Kokanee, will be reviewed for listing as well. It has also had repercussions for other animals that rely on salmonids for their own survival, for example, killer whales.
- Tribal treaty rights to salmon are part of the Steven's Treaties negotiated by the United States with the Native American Indian Tribes. Salmon are an important economic and cultural resource to tribes.
- Figs. 18.1 – 18.4 show the change in the number of adult salmon returning to spawn. They include four salmon populations in King County watersheds over approximately the last three decades. These graphs are illustrative of salmon decline generally, and depict large yearly variations in salmon returning to spawn. Some of that variation is due to natural variability unrelated to human influences. However, the decline in natural-spawning Chinook, Coho, and Sockeye stocks is considerably more enduring than would be expected from natural fluctuations. The impacts of habitat degradation, harvest management, hatchery operations and climatic factors contribute to this fluctuation. Habitat degradation caused by urban and industrial growth, forest practices, agricultural practices, municipal, industrial and agricultural water diversions, and hydropower have all contributed to diminishing the abundance and diversity of salmon.
- It is often very difficult to determine the relative importance of any single factor or combination of factors that can influence the status of a particular stock. Therefore this analysis will highlight observations regarding certain salmon species in watersheds within King County without attempting to link them to specific factors.
- The number of adults salmon returning to spawn in a given year is in part dependent on the number of young fish that were spawned, and then returned to the marine environment approximately two to four years previously. Thus, high and low adult escapement numbers can reflect spawning conditions in streams during that earlier period. Marine conditions and the number of fish taken in the marine fisheries can also impact the number of returning adults.

*Chinook*

- As Figure 18.1 shows, the total number of natural-spawning adult Chinook in the Lake Washington System reached a new low of 120 in 2000, after a low of 240 in 1999. The count of adult Chinook has been sparse compared to other stocks since data collection began in 1968. The number fluctuated between a low of about 450 and a high of over 2000 through the 1970s and 1980s. Overall, the average of runs in the 1990s are about one-half the average during the 1980s.
- In 1999 Puget Sound Chinook salmon were listed as a threatened species under the Endangered Species Act. In response to this listing, a Tri-County initiative within Snohomish, King, and Pierce counties has created a model program for local jurisdictions to preserve and restore salmon habitat.
- Fig. 18.2 shows the number of Chinook in the Snohomish/Snoqualmie Watershed. There was an overall declining trend from the late 1970s to the mid-1990s. In 1998, however, adult Chinook returned to this watershed in their highest numbers since 1980. This trend has continued into 2000, with 6,095 adults returning to spawn this past year.

**INDICATOR 18:**

*(continued from previous page)*

- Chinook stock in the Green River Watershed is classified as healthy by criteria used in the SASSI study (These criteria are different from those used in making listing determinations under the Endangered Species Act). In 2000, 6,170 adults returned to spawn, while 1999 saw the return of nearly 10,400 adults. There is considerable mixing of hatchery and wild fish in the Green River Watershed, which may make the count of natural spawning fish somewhat inflated over the actual number.

*Coho*

- In 1995, the National Marine Fisheries Service designated Coho in the Puget Sound/Strait of Georgia Evolutionarily Significant Unit (ESU) as a candidate for listing due to concerns over specific risk factors, including extensive habitat degradation.
- Fig. 18.3 above depicts Natural Coho in the Lake Washington System and the Green River Watershed. In 1970, a high of 30,000 fish was recorded in the Lake Washington System while a low of 200 was recorded in 1994.
- In 2000 about 1,950 Coho adults returned to Lake Washington. The average return in the 1990s, however, was much lower than in the 1970s and 1980s.
- The stock of Coho in the Green River Watershed shows similar fluctuation. After fairly health returns in 1994 – 1996, the numbers have again fallen off in 1997 – 2000.

*Sockeye*

- Sockeye escapement numbers in the Lake Washington/Cedar River watershed exhibit dramatic fluctuation. On the average there have been lower numbers returning during the 1990s than during the 1980s.
- The return of 230,000 Sockeye to the Lake Washington/Cedar River system in the summer of 2000 illustrates the volatility of the Sockeye population in this watershed. The combination of ideal spawning conditions in 1996 and a favorable marine climate during the next few years, favored the survival of that year's cohort. These conditions made it possible for hundreds of thousands of adult sockeye to re-enter Lake Washington during the 2000 season, on their way to spawning grounds throughout the Cedar River/Lake Washington watershed. Historically, a good year such as this, often alternates with very poor years. True trends can only be identified over the long term.
- In contrast to the 2000 season, in 1998 there were only about 10,000 adult Sockeye returns in Lake Washington and the Sammamish streams, and about 50,000 in the Cedar River. This total was about 50% of the previous year's total. In 1999 there were only about 2,500 in the lake and streams, and about 22,000 in the Cedar. After accounting for "good years" there remains a long-term trend toward a lower Sockeye population in the Cedar River Watershed.

## What We Are Doing

- Leading the Tri-County ESA Response together with Pierce and Snohomish Counties and various stakeholders to develop local responses to ESA listings that protect habitat and restore salmon populations.
- Leading or participating in various research initiatives through fish studies, water quality assessments, monitoring, and other research programs.
- Leading or participating in regional watershed planning processes to accomplish early action habitat improvements and to develop long-term salmon habitat conservation plans.
- Improving regulations, enforcement, and programs in all county activities including land use permitting, road maintenance, park maintenance, stormwater management, flood control, and wastewater treatment.
- Securing federal and state money for habitat acquisition and restoration work. Since 1998, King County has received almost $16 million for habitat improvements.
- Involving the public in fish recovery issues.
- Along with federal and state agencies, tribal governments, and Kitsap County, providing leadership in the development and implementation of the Shared Strategy for the recovery of salmon in Puget Sound. This is the venue for the establishment of recovery goals for Chinook, Bull trout, and other listed salmon in Puget Sound, and for the strategy that will link the efforts of watersheds and jurisdictions toward sustainable and harvestable stocks of these fish.

# ENVIRONMENT INDICATORS

## Indicator 18: Background Information

| Natural Coho | | | | Natural Chinook | | | Natural Sockeye | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Lake Washington Watershed | Green River Watershed | Snohomish/ Snoqualmie River Watershed* | Cedar River Watershed | Green River Watershed | Snoqualmie/ Snohomish River Watershed | Cedar River | Big Bear Creek | Issaquah Creek | Cottage Creek | Lake WA Beaches & Other |
| 1965 | 7,000 | 4,600 | | | | | | | | | |
| 1966 | 24,000 | 8,000 | | | | | | | | | |
| 1967 | 6,000 | 4,600 | | | | | | | | | |
| 1968 | 10,000 | 12,500 | | 1,363 | 3,110 | 5,214 | | | | | |
| 1969 | 7,000 | 3,400 | | 466 | 4,035 | 3,700 | | | | | |
| 1970 | 30,000 | 9,100 | | 1,745 | 11,171 | 5,724 | | | | | |
| 1971 | 17,000 | 5,700 | | 471 | 5,832 | 7,822 | | | | | |
| 1972 | 7,000 | 2,300 | | 419 | 4,343 | 3,128 | 225,862 | | | | |
| 1973 | 8,000 | 1,100 | | 1,025 | 3,180 | 4,841 | 314,194 | | | | |
| 1974 | 18,000 | 5,600 | | 560 | 5,095 | 6,030 | 114,472 | | | | |
| 1975 | 7,000 | 1,900 | | 656 | 3,394 | 4,485 | 114,106 | | | | |
| 1976 | 16,000 | 3,700 | | 416 | 3,140 | 5,315 | 138,949 | | | | |
| 1977 | 15,000 | 5,100 | | 675 | 3,804 | 5,565 | 410,020 | | | | |
| 1978 | 8,000 | 1,700 | | 890 | 3,304 | 7,931 | 262,733 | | | | |
| 1979 | 11,000 | 4,000 | | 1,243 | 9,704 | 5,903 | 172,300 | | | | |
| 1980 | 11,000 | 5,003 | | 1,360 | 7,743 | 6,460 | 347,827 | | | | |
| 1981 | 8,000 | 3,629 | | 624 | 3,606 | 3,368 | 90,694 | | | | |
| 1982 | 7,000 | 2,043 | | 763 | 1,840 | 4,379 | 253,658 | 17,871 | 9,842 | | |
| 1983 | 8,000 | 4,941 | | 788 | 3,679 | 4,549 | 193,338 | 20,720 | 2,937 | | |
| 1984 | 9,000 | 4,266 | | 898 | 3,353 | 3,762 | 336,960 | 21,335 | 2,437 | | |
| 1985 | 8,000 | 2,496 | | 766 | 2,908 | 4,873 | 223,745 | 20,160 | 2,054 | | |
| 1986 | 6,000 | 2,071 | | 942 | 4,792 | 4,534 | 217,133 | 22,982 | 2,491 | | |
| 1987 | 10,000 | 3,092 | | 1,540 | 10,338 | 4,689 | 177,841 | 18,844 | 1,000 | | |
| 1988 | 5,000 | 3,575 | | 559 | 7,994 | 4,513 | 359,000 | 8,779 | 5,536 | | |
| 1989 | 5,000 | 1,297 | | 558 | 11,512 | 3,138 | 162,000 | 1,795 | 1,306 | | |
| 1990 | 3,000 | 2,466 | | 469 | 7,035 | 4,209 | 76,000 | 10,115 | 707 | | |
| 1991 | 800 | 542 | | 508 | 10,548 | 2,783 | 77,000 | 7,691 | 1,588 | | |
| 1992 | 1,300 | 2,784 | | 525 | 5,267 | 2,708 | 100,000 | 27,533 | 23,979 | | |
| 1993 | 1,600 | 1,798 | | 156 | 2,476 | 3,866 | 76,000 | 9,848 | 3,351 | | |
| 1994 | 200 | 4,842 | | 452 | 4,078 | 3,626 | 109,000 | 39,645 | 700 | | |
| 1995 | 4,100 | 7,228 | | 681 | 7,939 | 3,176 | 22,000 | 2,329 | 385 | 382 | 1,100 |
| 1996 | 4,127 | 3,959 | 50,000 | 303 | 6,026 | 4,851 | 230,000 | 51,518 | 2,278 | 6,117 | 12,580 |
| 1997 | 2,300 | 1,451 | 58,200 | 227 | 9,967 | 4,295 | 104,000 | 6,714 | 2,832 | 882 | 1,580 |
| 1998 | <500 | 1,161 | 150,000 | 432 | 7,312 | 6,303 | 50,000 | 10,000* | | | |
| 1999 | 733 | 1,245 | 61,000 | 241 | 10,397 | 4,803 | 22,000 | 2,500* | | | |
| 2000 | 1,950 | 2,745 | 94,000 | 120 | 6,170 | 6,095 | 148,000 | 82000* | | | |

Data for the Snohomish-Snoqualmie basin were not collected for this report until 1998. Only the Snoqualmie portion, and parts of the Skykomish portion, of the Snohomish Watershed lie within King County.

* These numbers represents the total in the Lake Washington and Sammamish tributaries.

**Data Sources**: Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. *1992 Washington State Salmon and Steelhead Stock Inventory (SASSI) - Appendix One, Puget Sound Stocks, South Puget Sound Volume.*

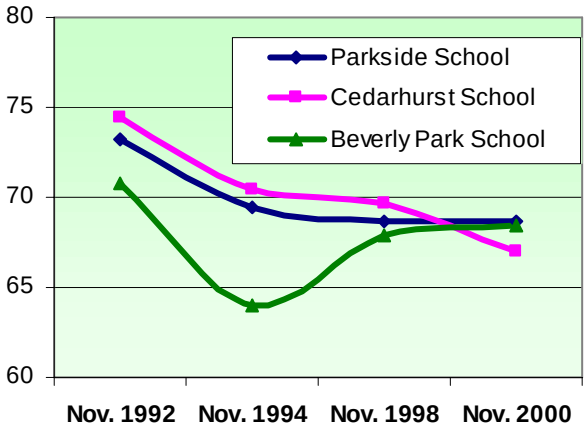
**Policy Rationale:** The policy rationale stems from Countywide Planning Policies FW-4, FW-5, CA-8, CA-9, CA-10, CA-11, and CA-15. Salmon are a symbol of the Pacific Northwest. They have important recreational, economic, cultural and environmental values for residents of King County. The health of salmon populations is an Indicator of environmental quality because land use policies and actions within the watershed affect these populations. The status of salmon populations indicates the overall health of rivers, lakes, and streams. This is because salmon are very sensitive to deterioration in water quality, sediment, temperature changes, and changes in the flow regime.

## *Outcome: Decrease Noise Levels*

**INDICATOR 19:** Rate of increase in noise from vehicles, planes, and yard equipment.

Fig. 19.1

**Day-Night Average Sound Levels (DNL) at Sea-Tac Intl. Airport Monitoring Stations: 1992 - 2000**

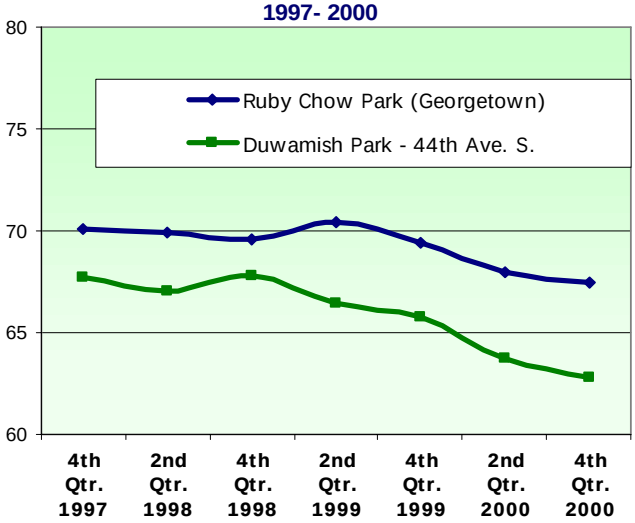



***Definitions and Notes:***

1. ***Day-Night Average Sound Level (DNL, previously known as Ldn)*** *is a noise measure used to describe the average noise exposure levels over a 24-hour period, typically an average day over the course of the year. It is based on an A-weighted (dBA) sound level scale (see below**).** It considers aircraft operations that occur between the hours of 10 PM and 7 AM to be 10 decibels louder than they actually are to account for increased annoyance. DNL is currently the accepted measure for aircraft noise analysis. Generally a DNL of 65 or greater is considered significant noise exposure, while a DNL of 75 or greater is considered severe noise exposure.*
2. ***DNL (or Ldn**) is also subdivided into aircraft only **(LDNA)** and community **(LDNC)** levels.*
3. ***A-Weighted Sound (dBA)** is a measurement representing a sound generally as the human ear hears it, by filtering out as much as 20 to 40 decibels of sound below 100 hertz (Hz). It is used for evaluation of community noise levels, as well as aircraft noise evaluations.*
4. *The Federal Aviation Administration certifies aircraft by noise levels. Stage 1 aircraft, the oldest and noisiest (e.g. B707) have been phased out of the fleet of aircraft operating in the U.S.*
5. *Stage 2 jet aircraft include models such as the Boeing 727, Boeing 737-200 and DC9. Stage 3 jets, the quietest in operation today, include the Boeing 757, Boeing 777, DC10 and others. Stage 3 jets also include aircraft that were Stage 2 when manufactured, but have since been hushkitted or re-engined to meet Stage 3 noise standards.*
6. *The monitoring station that is currently at Cedarhurst School was changed in 1999 from a site that was close by.*

Fig. 19.2

**Day-Night Average Sound Levels at King County Intl. Airport Monitoring Stations: 1997- 2000**




## About This Indicator

### *General*

- There are a number of sources of excess noise exposure in the community. Among the most significant are construction activity noise, traffic noise, transit vehicle noise, and poorly muffled yard and commercial maintenance equipment. Examples of approximate noise readings for typical urban occurrences are a jackhammer at 100 decibels or a fire engine at 103 decibels. The variability and randomness of many noise incidences make assessment of their contributions to community noise exposure exceedingly difficult.
- This report includes limited information about ongoing noise monitoring activities at Seattle - King County International Airport and Sea-Tac Airport. There is no source of comprehensive data available for other types of noise.
- High noise exposure is linked to hearing loss, sleep deprivation, and other stress related health concerns.
- More than four straight hours of exposure to

**INDICATOR 19:**

*(continued from previous page)*

noise levels between 80 and 110 decibels causes permanent damage that could eventually lead to significant hearing loss.

***Sea-Tac Airport***

- Based on its Noise Monitoring System, the DNL values at SeaTac have decreased from an average of 71 – 74 since the early 1990's (when a mediation agreement was developed to reduce overall noise) to 67 – 69 in 2000. From 1993 to 1997 the noise energy decreased significantly even though the number of departures and arrivals increased. This decrease can be attributed to the increase in the number of quieter Stage 3 aircraft at SeaTac, and the decrease in the number of noisier Stage 2 aircraft.
- As of January 1, 2000 the Federal government phased out the use of Stage 2 aircraft above 75,000 lbs. Some Stage 2 business jets remain in use because they are under 75,000 lbs.
- Noise levels at SeaTac Airport have remained about the same, or decreased more slowly during the 1998 – 2000 period.

***King County International Airport (KCIA)***

- LDNA values at KC International Airport have decreased regularly from the 4th quarter of 1997 to the 4th quarter of 2000, dropping from over 70 to 67 at one monitoring location, and from 68 to 63 at a second location.

## What We Are Doing

- Completing the Federal Aviation Regulation "Part 150" Study to plan mitigation efforts for the areas around the King County airport which experience DNL's of 65 or higher.
- Appropriating $500,000 for additional master planning work, following approval of the final work plan.
- Requiring that long-term leases at the airport provide for periodic review of compliance with relevant noise reduction regulations and policies.
- Preparing recommendations for consideration by the King County Council during the coming year. These recommendations may include measures such as
  - Building a sound wall at the north end of the airport bordering the Georgetown neighborhood
  - Providing sales assistance to homeowners that compensates them for loss of market value due to noise levels
  - Building an enclosure to mitigate noise from engine run-up and testing.

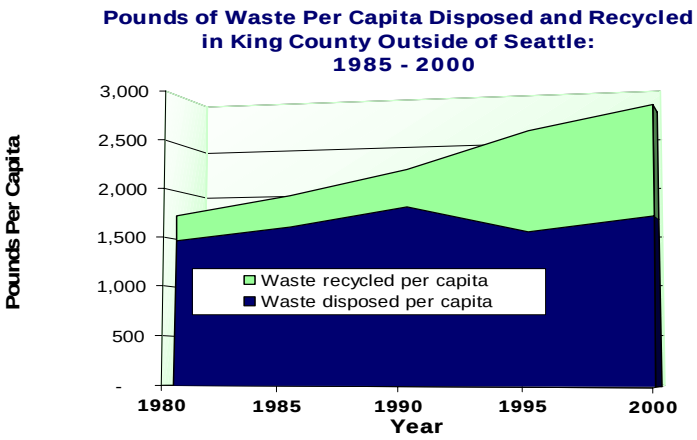
**Data Sources:** King County International Airport; Sea-Tac International Airport Community Program.

**Policy Rationale:** Although the Countywide Planning Policies do not contain specific policy direction for noise, the Benchmark Task Force added this Indicator because there were concerns about noise levels in King County. The Task Force also wanted to monitor how growth management issues affected noise levels.

## *Outcome: Decrease Waste Disposal and Increase Recycling*

**INDICATOR 20:** Pounds of waste disposed and recycled per capita.

Fig. 20.1




***Definitions and Notes:***

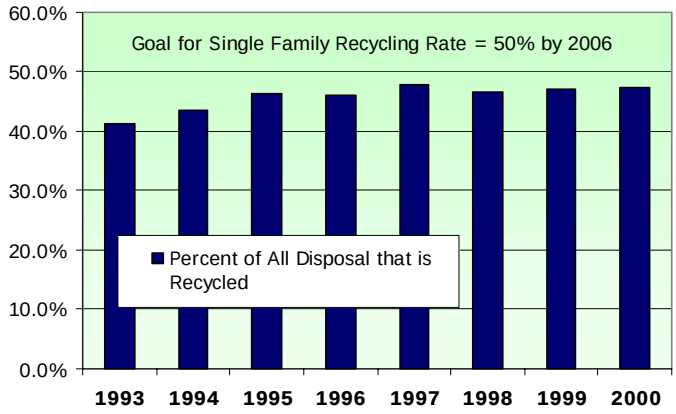
1. *Waste disposed includes residential and commercial waste, but excludes construction and land clearing debris, which was banned from the King County Solid Waste Division's transfer stations and Cedar Hills landfill in 1993. Special waste figures are also excluded.*
2. *Fig. 20.1 shows the historical trend for all of King County outside of Seattle. Seattle did not supply data for 2000.*
3. *All figures are estimates: disposal data from King County Solid Waste Division's tonnage records; recycling figures obtained from state surveys or model-derived.*
4. *Recycling figures include yard waste but exclude ferrous metals.*
5. *Fig.20.2 includes curbside recycling by residents of single-family dwellings or buildings with four units or less.*

**INDICATOR 20:**

*(continued from previous page)*

***Fig. 20.2***

**Single Family Curbside Disposal:**
**Percent of Total Disposal That is Recycled**




## About This Indicator

- King County continues to do well in its recycling efforts. In 2000, nearly 1,100 lbs. per person were recycled in King County outside of Seattle, up significantly from about 250 lbs. in 1980, and 380 lbs. in 1990. Data for the City of Seattle are not included here.
- Fig. 20.1 deals with aggregated residential and commercial waste disposal per capita. King County is now recycling almost three times as much per person as it was in 1990.
- Although both the total and per capita amounts of waste generated continue to grow, the proportion of waste that is recycled has grown considerably since 1990.
- This indicator measures both the amount of materials recycled per person each year and the amount of waste disposed of (and thus, not recycled or reused). Ideally, the total amount of waste generated would be declining, while the amount recycled would rise, or remain the same. For example, conservation and creative re-use of materials, and less use of excess (or non-recyclable) packaging helps to decrease the overall amount disposed, without necessarily affecting the amount recycled.
- Seattle and King County serve as employment and population centers for the region. The relatively high level of economic activity and the large number of individuals working in the region may be responsible for the increase in waste generation per capita, since growth in business activity (which produces waste) has outpaced growth in County population.
- Fig. 20.2 deals with residential curbside disposal. Since 1993 there has been a gradual increase in the proportion of residential waste that has been recycled. It has remained around 47% for the past three years. The goal is to reach 50% recycling by 2006.
- About 77% of residents living in single family homes or buildings with four units or less participate in curbside recycling.

## What We Are Doing

- Continuing to recycle a significant part of our waste, both residentially and commercially.
- Seeking ways to recycle and reduce more of the waste stream not currently included in curbside recycle programs, such as food waste recycling.
- Examining “new wastes” such as used computer equipment, and devising ways to reduce and reuse this waste stream.
- Encouraging King County manufacturers to practice environmental stewardship by considering, at the product design stage, how to reduce toxic materials, conserve energy, reuse materials, and recycle.
- Educating and encouraging builders and residents to consider sustainable or “green” building practices, such as the use of recycled construction materials, and structure design which minimizes resource use.

**Data Sources**: King County Department of Natural Resources: Solid Waste Division, Planning and Communications Section.

**Policy Rationale:** Although the Countywide Planning Policies do not include policy direction for reducing solid waste or promoting recycling programs, the Benchmark Task Force added this Indicator, because recycling and reductions in solid waste save resources, save landfill space and reduce the potential for soil and water contamination due to leakage from landfills.